

CLAIMS

1. An apparatus for the actuation of a plurality of pivotable external elements of a vehicle (6, 7, 8, 15, 16) which are top elements of a top (1) of a convertible vehicle (2) and comprise at least foldable roof elements (6, 7, 8), of which at least one roof element (8, 15, 16) is pivotably connected to the vehicle body (9), with at least one pivot joint (10A, 10B, 10C, 10D, 10E, 10F, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B, 42, 43, 44, 45) and at least one drive (18, 19, 20, 21, 22) being provided for the pivoting of the top elements (6, 7, 8, 15, 16) with respect to one another or with respect to the vehicle body,
characterized in that
an electric motor (18, 19, 20, 21, 22) is provided as a drive for pivot joints (10A, 10B, 10C, 10D, 10E, 10F, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B, 42, 43, 44, 45) of connections at least between the top elements (6, 7, 8, 15, 16) to one another, said electric motor introducing a drive torque directly into an associated pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43), with at least one pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B, 42, 43) of different connections being separately controllable.
2. An apparatus in accordance with claim 1,
characterized in that
a torque of the electric motor (18, 19, 20, 21, 22) can be introduced by means of a flexible shaft (23) into a pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43).
3. An apparatus in accordance with either of claims 1 or 2,
characterized in that

at least two pivot joints (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43) oppositely disposed with respect to a longitudinal axis of a vehicle are connected in each case to the electric motor (19, 20, 21, 22) by means of flexible shafts (23).

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4. An apparatus in accordance with any one of the claims 1 to 3, characterized in that at least some of a plurality of pivot joints (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43) are made of the same construction.

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5. An apparatus in accordance with any one of the claims 1 to 4, characterized in that the pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43) is driven by means of a transmission device (24), with the transmission device (24) being arranged between a lever (3) associated with a first external element of a vehicle (6) and a further lever (4) of a second external element of a vehicle (7).

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6. An apparatus in accordance with claim 5, characterized in that a flexible shaft (23) transmitting the torque of the electric motor (18, 19, 20, 21, 22) is rotatably connected to a screw (25) of the transmission device (24), said screw (25) being in engagement with a first gear (26) supported at one of the levers (4), said gear being in engagement with at least one second gear (27) and being actively connected to the second lever (3).

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7. An apparatus in accordance with any one of the claims 1 to 6, characterized in that

a position detection sensor (29) is arranged at the pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43).

8. An apparatus in accordance with claim 7,
5 characterized in that
the position detection sensor (29) is made as a potentiometer, with a striker being provided in the transmission device (24) of the respective pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B, 17A, 17B; 42, 43) coaxially to the respective pivot axle (A1, A2, A3, A4, A5), the potentiometer (29) being arranged on said
10 striker.
9. An apparatus in accordance with any one of the claims 1 to 8,
characterized in that
an adjustable abutment (32), in particular an abutment made with a regulating
15 screw (33), is provided at the pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B; 42, 43).
10. An apparatus in accordance with any one of the claims 1 to 9,
characterized in that
20 the pivot joint (10A, 10B, 11A, 11B, 13A, 13B, 14A, 14B; 42, 43) is made rotatable by at least approximately 360°.
11. An apparatus in accordance with any one of the claims 1 to 10,
characterized in that
25 an electric motor (18, 19, 20, 21, 22) is associated with each connection of the top elements (6, 7, 8, 15, 16) to one another or to the vehicle body (9) around a pivot axle (A1, A2, A3, A4, A5).

12. An apparatus in accordance with any one of the claims 1 to 11,
characterized in that
a connection of the top elements (6, 7, 8, 15, 16) to one another or to the vehicle
5 body (9) is formed by at least one controllable pivot joint (10A, 10B; 42, 43) and
by at least one passive pivot joint (10C, 10D, 10E, 10F; 44, 45), with the
associated pivot axle (A4) of the connection being a pivot axle of a passive pivot
joint (10C, 10D).
- 10 13. An apparatus in accordance with any one of the claims 1 to 12,
characterized in that
a plurality of electric motors (18, 19, 20, 21, 22) are connected to a central
electrical control unit.
- 15 14. An apparatus in accordance with any one of the claims 1 to 13,
characterized in that
at least some of the electric motors each have a control unit which is connected in
each case via a data bus to at least one further control unit for at least one electric
motor.
- 20 15. An apparatus in accordance with any one of the claims 1 to 14,
characterized in that
three roof elements (6, 7, 8) are provided which can be folded together in S-shape
such that a front roof element (6) is stowed in a folding position with an open top
25 (2) rearwardly pivoted over a middle roof element (7) and a rear roof element (8)
which lies below it and is likewise rearwardly pivoted with respect to its position
with a closed top and, on an opening movement of the top (2), the front roof

element (6) is pivoted upwardly and rearwardly around a first pivot axle (A1), the middle roof element (7) is pivoted around its rear second pivot axle (A2) and the rear roof element is pivoted rearwardly around its rear third pivot axle (A3), with the pivoting of the front roof element (6) selectively taking place substantially
5 before or during or after the pivoting of the middle roof element (7) and of the rear roof element (8).

16. An apparatus in accordance with any one of the claims 1 to 15,
characterized in that,
10 on an opening movement of the top (2), a clamp (15) is first raised for the release of a upwardly pivoting movement of a top storage well cover (16) and is lowered again after the putting up of the top storage well cover (16), after which the roof elements (6, 7, 8) are placed on the clamp (15).

15 17. An apparatus in accordance with any one of the claims 1 to 14,
characterized in that
three roof elements (6, 7, 8) can be folded such that, on an opening movement of the top (2), a middle roof element (7) is first pivoted around its rear pivot axle (A2) and a rear roof element (8) is pivoted rearwardly around its rear pivot axle
20 (A3); and, in an at least approximately horizontal position of the rear roof element (8), a front roof element (6) and the middle roof element (7) are placed down such that the middle roof element (7) is pivoted on the rear roof element (8) and at least approximately parallel thereto and the front roof element (6) is pivoted
downwardly in respect to this into an at least approximately vertical position.

25 18. An apparatus in accordance with any one of the claims 1 to 17,
characterized in that,

on an opening movement of the top (2), a top storage well cover (16) is first pivoted upwardly and, in the stowage position of the roof elements (6, 7, 8) is pivoted downwardly into an at least approximately horizontal position.

5 19. An apparatus in accordance with any one of the claims 1 to 18,
characterized in that
at least one external element of a vehicle is a cover element (16), in particular a
top storage well cover or a gate cover, which can be raised from a closed position
at least at one edge (16A) by pivoting by means of at least one drivable pivot joint
10 (42, 43) and at least one associated drive (22) around an oppositely disposed edge
(16B).

20. An apparatus in accordance with claim 19,
characterized in that
15 the at least one drivable pivot joint (42, 43) engages at a linkage (46) which is
hingedly fixed at one end to the vehicle body (9) and is hingedly fixed at the other
end to a region of the cover element (16) disposed in the longitudinal direction of
the vehicle spaced from a pivot axle (A5) of the cover element (16), with the
linkage (46) being formed from two mutually connected levers (47, 48) which are
20 preferably made with different lengths and with a connection of the levers (47, 48)
to one another and at least one of the hinged connections to the cover element (16)
or to the vehicle body (9) being formed with a drivable pivot joint (42, 43).

21. An apparatus in accordance with claim 20,
25 characterized in that
the cover element (16) can be latched in its closed position by pivoting the linkage
(46) into a dead-center position or over-center position.

22. An apparatus in accordance with any one of the claims 19 to 21,
characterized in that
the at least one drivable pivot joint (42, 43) is designed manually adjustably for
5 emergency activation in the deactivated state.
23. An apparatus in accordance with any one of the claims 19 to 22,
characterized in that
the cover element (16) is fixed to the vehicle body (9) at the edge (16B) associated
10 with its pivot axle (A5) by means of at least one passive pivot joint (45), in
particular a swan neck bearing (45).